



Case report

Tissue preservation and projectile context in a Spanish Civil War victim

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ABSTRACT

Exhumations of mass graves containing the remains of those executed during the Spanish Civil War and the subsequent Franco regime are currently being conducted at the request of surviving relatives. This individual case report illustrates how soft tissue preservation, through copper ion contact in one particular victim aided in preserving the projectile in an anatomical context, thereby permitting the correct interpretation of the projectile's path and angle, which otherwise would not have been possible as no bone tissue was affected. The information obtained has important relevance for human rights investigations and the work of the forensic anthropologist.

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1. Introduction

During the Spanish Civil War (1936–1939) and within the subsequent Franco dictatorship (1939–1975) thousands of civilians were subjected to political persecution.¹ The affected individuals were removed from their homes, places of work or other life-contexts, and summarily executed by gunfire. Their remains were interred in mass graves which were often situated along roads, or within wooded areas. The victims are normally referred to as *paseados*, which translates to “taken for a ride”; this practice was frequently utilized during the Civil War, but gradually waned over time during the post war era [S. Macías personal comm.].

Within the modern context, investigations pertaining to these violations of human rights are being actively conducted; an on-going part of such investigations involves the exhumation of victims being presently engaged upon, at the request of victim's families, by the Association for the Recovery of Historical Memory (ARMH).¹

In the majority of cases, such victims display projectile-related trauma on cranial and facial bone tissue, making it possible to effectively and accurately determine entrance and exit wounds, and the angles and paths of projectile entrance. Within the context of a minority of cases, a negative trauma outcome may be obtained, as injuries inflicted in some instances may totally bypass bone structures. Moreover, upon occasion, the association of a projectile

with a particular body is not possible, due to the commingled condition in which remains may be present within particular mass graves, and when circumstances dictate the application of rescue archaeology due to time constraints, limited personnel and budget issues. The case presented here is of particular interest, as it demonstrates how tissue preservation through copper contact, aided the location of the site of impact in a specific victim where no bone structures had sustained visible damage.

2. Case report

2.1. Mass grave

During July of 2008, the exhumation of a mass grave containing four victims who perished at the commencement of the Spanish Civil War was conducted in the northwest area of the Spanish Autonomous Community of Castilla and León. The said individuals were in a skeletonised condition, and were arbitrarily numbered from one to four. Whereas body number one was discovered in an extended position and facing downwards, the balance were in a semi-flexed state. All of the remains were in direct contact with each other (Fig. 1), dictating extreme care whilst removing and processing each individual. However, upon examination, body number four presented a leathery, whitish mass, located under the left side of the mandible and also upon the left side of the cervical area of the spine (Fig. 2). Under the instructions of the author, the mandible and cervical vertebrae, along with the solid mass were carefully lifted and packaged, preserving the association as

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Fig. 1. The four bodies as found *in situ*.

discovered *in situ*. The remains were subsequently transported to a laboratory in the city of Ponferrada for formal analysis.

2.2. Bone analysis

The recovered remains were examined in the laboratory, following forensic anthropological techniques, in order to compile a biological profile of each victim, and to locate and analyse any evidence of trauma.

All four individuals in this case were white adult males. Body number one presented a fragment of parietal bone exhibiting trauma associated with a projectile entrance wound. Body number two did not present any evidence of trauma; however, it must be highlighted that in the case of the said individual, the thorax and skull had been damaged during the initial search as a result of the use of a mechanical digger. Body number three exhibited a fragmented frontal bone presenting two radiating fractures associated with either a projectile or blunt force trauma.²

With reference to individual number four, upon initial inspection, no clear evidence of trauma was detected. The previously mentioned solid mass had adhered strongly to vertebrae C3–5, but not to the mandible (Fig. 3); upon closer examination, this mass proved to be composed of desiccated outer skin, including the



Fig. 2. Leather-like whitish mass in context with body number four.

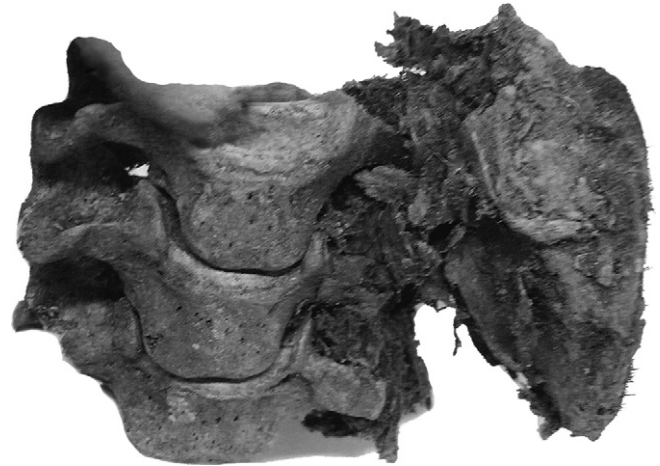


Fig. 3. Preserved soft tissue on C3–5.

presence of facial hair. It is a widely accepted element of post mortem protocols to utilize X-rays or more advanced radiological imaging techniques such as multi-slice computed tomography (MSCT) or cone-beam computed tomography (CBCT), when examining soft tissue. This is especially important when working with bodies believed to have been killed by gunshot, as was the case of the said individuals, when execution via shooting was the norm. By following this simple step, the location of shrapnel, embedded projectiles or internal damage can be readily accomplished, making it possible to evaluate the situation via a non-invasive procedure.^{3,4} However, due to the lack of access to such equipment by the ARMH, the author carefully dissected the white mass in order to examine the tissue. Although not the most ideal method of approach, the procedure was carefully documented via photographs and notes.

Within it, desiccated internal tissue was observed and a foreign object was discovered, which was carefully removed and subsequently identified as a 9 mm copper jacketed projectile. Upon its removal, metal residue spilled out, creating a hollowed-out area (Fig. 4).

Internally, the mass presented a bluish-green stain; the same colouration was noted along the left transverse foramen of C3, and also on C4 left inferior articular facet, an effect typically observed in association with copper staining.^{5–8} Based upon the position at which the projectile was located, the trajectory was identified as travelling from back to front on the left side of the neck, at a 45-



Fig. 4. Preserved tissue and metal particles after removing the projectile.

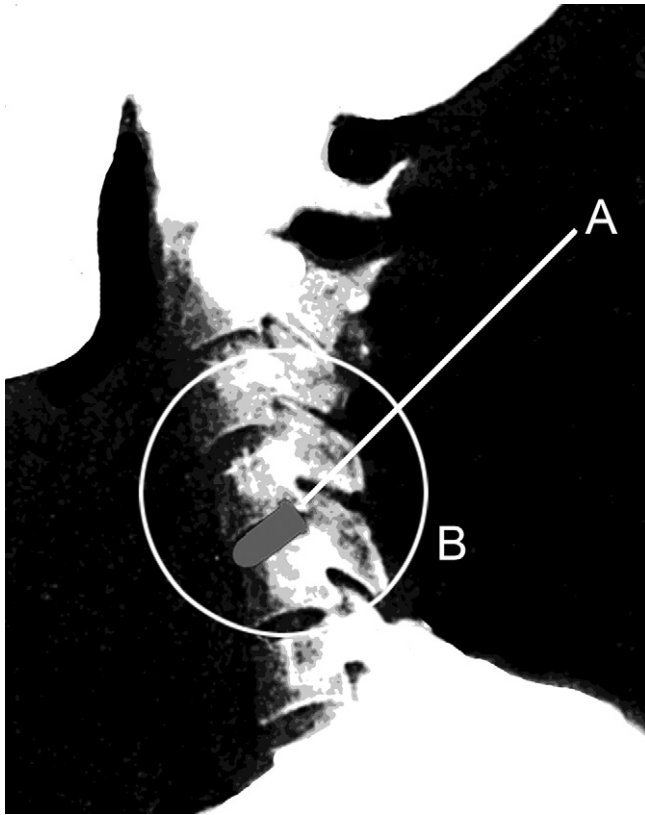


Fig. 5. (A) Bullet path at a 45 degree angle. (B) Lodged projectile. Not to scale (Human figure modified from Van De Graaff KM. *Human Anatomy*. Dubuque: Wm. C. Brown Publishers; 1984).

degree angle, eventually lodging between C4 and C5 (Fig. 5). However, none of the bone structures were affected by the impact.

There are factors that contribute to a projectile's loss of kinetic energy, thus causing it to become embedded. Such variables include the bullet velocity, mass, the angle of yaw during flight and upon impact with the victim, the calibre, construction and its configuration. Additionally, the density, strength, and elasticity of the impacted tissue also play a part. Other aspects may include distance of shot, an intermediate target present and the position of the attacker in relation to the victim;^{9,2,3,10} however, the specific details surrounding this particular case are unknown.

3. Discussion

After death, human soft tissue either decomposes or is preserved, depending upon a variety of processes influenced by both intrinsic and extrinsic factors, wherein humidity and temperature are key factors to either favour or hinder bacterial action.^{11–13} Soft tissue preservation may occur in a variety of contexts, such as outdoor settings, crevices and caves, enclosed structures, and also within burial sites. In such circumstances, when the local ambient conditions are dry, and associated with either extreme hot or cold weather, the evaporation of moisture is permitted, which denies bacterial action, and encourages natural, spontaneous desiccation.^{14–17,7} However, tissue preservation may also occur as a result of contact with copper.

Copper (Cu) corrodes rapidly, followed by the formation of a stable corrosion protection layer, which inhibits further degradation.¹⁸ Items containing copper alloy are known to preserve organic material, including human soft tissue, when in direct

contact, even when other organic remains have disappeared, as it is observed in the archaeological record. The preservative action of copper upon organic matter is due to its ability to retard microbial action, as it is toxic to microorganisms. This process occurs when copper ions present within the copper alloys permeate the organic matter and act as a biocide, arresting the activity of enzymes involved in the normal processes of decay.^{18,19,11,13}

With reference to forensic cases, during the literature search for this publication, it was noted that human tissue preservation was reported on the basis of natural or human intervention, purposeful or accidental, in which internal organs were preserved, and where sex and trauma could be accurately determined.^{20,16,21,22} However, no references were found pertaining to tissue preservation in association with copper alloys aiding forensic analysis.

The case reported here demonstrates how copper ions, such as those which permeated from the inside out in individual number four, caused preservation on adjacent tissues, allowing the retention of the projectile *in situ*, enabling the recovery of the said projectile within an anatomical context, and the determination of the angle and direction in which it travelled. If such a manner of preservation had not occurred, important data would have been lost, as the action of this particular projectile did not create any evidence of trauma upon the associated bone structures. Importantly, the specific context of the projectile with body number four might not have been positively established, keeping in mind that the accuracy of contexts is vitally important within forensic cases, and with specific reference to the proper investigation of human rights abuses.

Conflict of interest

None declared.

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Ethical approval

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